

"Pre-Medical" Informatics

David L. Ranum, Ph.D., Interdisciplinary Knowledge Engineering Laboratory
Department of Computer Science, Luther College, Decorah, Iowa

Many authors have presented arguments in the recent medical literature discussing the premedical preparation of medical students. Much of this work seems to center upon the need to balance the strong science concentration with an increased emphasis on humanities courses. This paper investigates another potential shortcoming of premedical education, that of information literacy. It defines the problem, argues its existence, and proposes the ready availability of a solution.

INTRODUCTION

Information literate people are defined to be those who (1) know when they have a need for information, (2) can identify information needed to address a given problem or issue, (3) can find needed information, and (4) can evaluate and organize information to effectively address the problem at hand [1]. It has been suggested that many of the major changes that will take place in medicine over the next decade will be in response to the information revolution and the accompanying advances in information technology [2]. In response to the need to be information literate, the medical community has begun to initiate the formation of medical informatics departments, name chief information officers, utilize information technology for patient care, and to attempt to expose students to the rigors of information management.

Although medical informatics education has typically been an endeavor placed in the realm of post-graduate or late medical school curricula, there has been great enthusiasm over the past decade for the integration of information technology into all phases of the typical undergraduate medical education [3]. This paper will argue that the probability of success for such a program could be increased if entering medical students had exposure to the basic ideas of information literacy prior to their exposure to the domain specific concepts from medicine. Further, such a need has been identified among practicing physicians. Finally, this exposure is possible given the current trends in premedical

education and the availability of pertinent coursework within the baccalaureate institutions.

THE NEED FOR INFORMATION LITERACY

Much has been written pertaining to the premedical preparation of medical students [4,5,6]. The common motivating factor is the predisposition for premedical students to concentrate heavily on science courses such as chemistry, biology, and physics as is often stressed in medical school admissions criteria. Unfortunately, this tends to lead the student away from other courses, especially those in the humanities, that have been shown to have long term implications for the practicing physician.

To consider this question in more detail, a premedical preparedness survey was sent to all practicing physicians (280 total) who had earned a baccalaureate degree from a highly respected national liberal arts college between 1961 and 1987. Contrary to similar studies, the results of this survey showed that these liberal arts physicians felt that they had achieved a balance between their science and non-science coursework [7]. However, the existence of yet another preparedness problem, that of information literacy, was made clear from the following results:

(1) The top three departmental course offerings physicians wished they had taken as part of their premedical training were in computer science, management, and management information systems.

(2) 83% of the physicians had utilized computers in their practice at one time or another however the majority simply used word processing.

Discussion

The use of word processing technology, although certainly falling under the framework of computer literacy, does not in itself allow a physician to tap into the power of information. Information literacy includes computer literacy as a basic component but extends much further into the realm of identification, acquisition, and analysis of information. The

overwhelming interest in computer science and information management courses at the baccalaureate level are indicative that a need for information literacy exists.

(3) 55% of the physicians consider themselves unable to use information technology for the purpose of enhancing their professional lives.

(4) 75% spend a significant portion of their time simply trying to manage the gross medical information they are exposed to.

(5) 62% of those physicians emphatically state that this management task utilizing their current methods is not a good use of their time.

Discussion

Although information management is clearly a basic element of the practice of medicine, it seems inappropriate that such a large percentage of physicians view the task as a poor and inefficient use of their time. However, in conjunction with the fact that less than one-half of these physicians stated that they can utilize technology in such a way as to enhance their professional lives, this result seems more plausible. The statements made by these physicians are in response to an inability to cope with the large amount of information simply utilizing techniques of the past. There is a need to either update or expose these physicians to current informatics concepts.

(6) 14% of the physicians were familiar with the academic discipline of medical informatics.

Discussion

As an academic discipline, medical informatics is relatively new and therefore is still relatively unknown. This is not to say that the results of medical informatics are unknown to most as is evident by the fact that nearly all physicians in this survey had at one time utilized technology to perform literature search. The nature of the discipline is perhaps more obvious from its results rather than from its name.

In summary, the results of this survey indicate that although students were satisfied with their premedical preparation from the common non-science point of view, there were clearly gaps in their information literacy skills. It is suggested then that the study of informatics can provide this element. In

other words, the study of informatics can promote information literacy.

PREMEDICAL INFORMATICS

The trend over the past decade in typical baccalaureate curriculums has been to place importance on the acquisition of computer literacy skills. For the future physician, these skills, although perhaps useful, are certainly not enough to cope with the information demands that will become evident as medical study and practice begins. It is unfortunate, however, that these students are not made more aware of the importance of gaining an understanding of information literacy during their premedical years. Most are not prepared for the overwhelming amount of intense study that must occur in their medical training. To attempt to learn information literacy at this point, out of a need for survival, is certainly not a promising way to proceed. Further, the advantages of information technology may not be obvious to such a student due to the overshadowing nature of medical study. For these students, information literacy via premedical informatics study is certainly an acceptable endeavor.

Although medical informatics study is not available to most premedical students, the general principles of informatics can be presented to students during these critical years. In addition, due to the admission requirements of most medical schools, the baccalaureate years provide ample time to pursue such courses in an environment suitable for learning the fundamental concepts. To this end, the following three knowledge categories have been identified for pre-medical informatics advising: (1) Computer Science, (2) Mathematics, and (3) Library Science. Table 1 shows an expanded version.

The goal of these knowledge categories is to provide a small set of concepts that premedical students can utilize when being advised relating to coursework that will serve them as future physicians working in an information rich environment. Each topic listed within a knowledge category is readily available at most universities and colleges to any undergraduate student via a number of different domain dependent or independent courses (e.g. mathematical statistics, biostatistics, and psychology statistics are all potential sources of statistics concepts). Also, many of these courses require few if any prerequisites.

Table 1. PreMedical Informatics

Computer Science

- history
- theory of computation
- what is possible
- complexity
- algorithm development
- problem solving
- programming
- database management
- concepts
- design, query, and report
- networks
- concepts
- internet, e-mail

Mathematics

- statistics
- software packages
- interpretation of data
- discrete structures
- logical reasoning skills

Library Science

- search
- MEDLINE
- CARL
- literature analysis
- critical interpretation

It should be noted that these advising suggestions are in no way meant to take the place of formal medical informatics training that will be provided by academic and clinical staff once these students begin their medical studies. The intent is to provide a set of fundamental courses that students who are interested in choosing premedical study based upon later relevance can utilize. From an advising point of view, students are encouraged to take broad based course selections while at the same time filling potential gaps in their own knowledge bases. It is assumed that by increasing the awareness of information literacy thru premedical informatics study, these students will be better prepared to undertake the domain specific challenges that lie ahead.

DISCUSSION AND CONCLUSION

Premedical course selection provides the future physician with an excellent opportunity to become information literate while at the same time preparing

for medical study. Unfortunately, most premedical students do not take advantage of these opportunities. For example, in a survey of 44 current medical students, 43% had taken a single seven week computer literacy course and only 1 student had attempted to study further in computer science. Likewise, only 20% had any exposure to statistics of any kind although almost all had taken calculus due to admission requirements by medical schools. With respect to the informatics knowledge categories, very few students had selected in these areas.

It is commonly accepted that change will be an inevitable result of current advances in information technology. In the medical arena, physicians must be given educational opportunities that will allow them to cope with these changes. Due to the rigors of medical study, it is perhaps even more important to expend effort during the premedical years in an attempt to build a solid foundation that will be present long after medical school. This effort with respect to informatics not only serves the physician but also serves the discipline of medical informatics. It is clear that not all medical students are interested in pursuing a career in medical informatics. However, it is certainly the case that information literacy has and will continue to play an essential role in the practice of medicine. For this reason, premedical informatics is certainly a worthy area of study.

Reference

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